

HLP-2021-0003

**NAVIGATOR HEARTLAND GREENWAY, LLC
PETITION FOR A HAZARDOUS LIQUID PIPELINE
Docket No. HLP-2021-0003
VARIOUS COUNTIES, IOWA**

EXHIBIT F

**1.0 THE PURPOSE OF THE PROJECT/HOW THE PROJECT PROMOTES THE PUBLIC
CONVENIENCE AND NECESSITY**

Navigator Heartland Greenway, LLC (NHG) is proposing to design, build, and operate the Heartland Greenway Pipeline System (HGPS), a new interstate pipeline across parts of Illinois, Iowa, Minnesota, Nebraska, and South Dakota. The HGPS is the midstream transportation portion of a new carbon capture, use, and sequestration system being developed by NHG's parent company, Navigator CO₂ Ventures LLC (NCO₂V), across parts of the Midwest and collectively referred to herein as the "Project." The Project is being developed by NCO₂V, with NHG being a wholly-owned subsidiary of NCO₂V and the company designing, constructing, and operating the interstate HGPS. NHG's affiliate companies are developing the other portions of the HGPS, with Navigator Carbon Services LLC (NCS) developing carbon capture and compression systems and HG Carbon Storage LLC (HGCS) developing the sequestration facilities. Carbon dioxide (CO₂) emissions from ethanol and fertilizer facilities along the HGPS route that are currently being emitted into the atmosphere are captured and compressed into a dense phase and safely transported through HGPS to either (1) a permanent and secure underground sequestration site operated by HGCS and/or (2) a terminal for distribution to industrial users of CO₂.

The Heartland Greenway Pipeline System will promote and benefit the ethanol, fertilizer, and agriculture industries by enhancing their long-term environmental and economic sustainability; it will also help resolve supply chain constraints by providing additional supply to Iowa's industrial users of CO₂, such as food and livestock processing. The Heartland Greenway Pipeline System will benefit carbon emitters inside and outside of the state of Iowa, which will have benefits to all Iowans from the reduced carbon emissions. Carbon capture is a crucial part of the ethanol industry's commitment to reducing carbon intensity to 70% lower than petroleum gasoline by 2030, and carbon neutrality by 2050,¹ and only with projects like the Heartland Greenway Pipeline System can the ethanol industry achieve such ambitious goals.

NHG and its affiliates have secured agreements with 20 ethanol producers and one fertilizer facility along the project footprint to support development of the Heartland Greenway Pipeline System that will have an initial CO₂ transportation capacity of approximately 10 million metric tons (MMt) per year. NHG will reserve capacity equal to approximately ten percent (10%) of the transportation capacity available for use by noncommitted shippers if they nominate and tender CO₂ for transportation services in accordance with the terms of NHG's tariff and meet all quality and safety specifications. Transportation service on the pipeline will be provided by NHG in accordance with rules and regulations in the tariff, which are based on Federal Energy Regulatory Commission tariff principles governing interstate transportation of a

¹ Isaac Emery, et al., Informed Sustainability Consulting (prepared for Renewable Fuels Ass'n), *Pathways to Net-Zero Ethanol: Scenarios for Ethanol Producers to Achieve Carbon Neutrality by 2050* (Feb. 14, 2022), available at <https://PathwaystoNetZeroEthanolFeb2022.pdf>.

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commodity in a pipeline. NHG conducted public open seasons in 2021 whereby it solicited commitments from any CO₂ emitters in the project's footprint that desired to be connected to the Heartland Greenway Pipeline System for carbon capture, utilization, and storage (CCUS) of their CO₂ emissions, and NHG continues to solicit any CO₂ emitters in the project's footprint to provide those services as a common carrier.

The Heartland Greenway Pipeline System will promote the public convenience and necessity in multiple ways:

1. **Strengthen the Ethanol and Fertilizer Industries.** First, the Heartland Greenway Pipeline System will strengthen the ethanol and fertilizer industries across the project footprint. The ethanol industry supports approximately 407,000 jobs in the United States each year,² including approximately 39,000 jobs in Iowa.³ The fertilizer industry supports approximately 487,000 jobs in the United States each year,⁴ including approximately 32,000 jobs in Iowa.⁵ NHG has secured agreements with 21 facilities along the project footprint, including 20 ethanol producers and an Iowa fertilizer plant. Capturing and sequestering CO₂ using the Heartland Greenway Pipeline System affords the participating facilities opportunities to utilize federal tax credits [26 U.S. Code § 45Qt] and participate in voluntary carbon offset markets. In addition, the carbon intensity score of the ethanol produced from plants using the Heartland Greenway Pipeline System for sequestration can be reduced by as much as fifty percent (50%)⁶ making them more competitive in the low-carbon fuel markets that pay premiums for low carbon ethanol. Finally, ethanol plants that wish to market their CO₂ to industrial end users will have a transportation option to reach customers in scale that may otherwise be too far for traditional trucking options to be economic in the quantities demanded for such uses. This economic savings will allow industrial users such as food processors to potentially lower their costs and provide more cost-competitive products to the citizens of Iowa. All of these factors increase the economic strength and durability of Iowa's manufacturing sector, especially the ethanol and fertilizer industries, which in turn benefits employees, suppliers, communities, citizens, and governments in Iowa where the plants are located.

CO₂ reduction by ethanol producers is crucial to the long-term survival and success of the industry, and projects like the Heartland Greenway Pipeline System are key to such facilities being able to produce a reduced-carbon intensity and, eventually, a carbon-neutral product to meet the demands of the market. It is likely that without CO₂ reduction many ethanol plants will not be competitive and may not survive as more areas are adopting low carbon fuels standards such that it is anticipated to become the new baseline carbon fuel standard. Many other industries, including fertilizer producers, face similar pressures regarding the sales of their products as the market continues to demand increasingly carbon-friendly production. Projects like the Heartland Greenway Pipeline System are vital to their long-term success and

² John M. Urbanchuk, ABF Economics (prepared for Renewable Fuels Ass'n), *Contributions of the Ethanol Industry to the Economy of The United States in 2021* (Feb. 3, 2022), available at <https://RFAEconomicImpactReport.pdf>.

³ John M. Urbanchuk, ABF Economics (prepared for Iowa Renewable Fuels Ass'n), *Contribution of the Renewable Fuels Industry to the Economy of Iowa* (Feb. 15, 2022), available at <https://iowarfa.org/Iowa-Biofuels-Impact.pdf>.

⁴ The Fertilizer Inst., *Fertilizer Grows Jobs: Feeding Crops While Growing the U.S. Economy* (2020), available at <https://tfitest.guerrillaeconomics.net/res/National%20Infographic.pdf>.

⁵ The Fertilizer Inst., *Iowa State Report* (2020), available at <https://tfitest.guerrillaeconomics.net/reports/3893d3be-5979-4efc-a645-c46da29d7a55>.

⁶ Growth Energy, *Achieving Net-Zero Ethanol* (Sept. 2021), available at <https://growthenergy.org/wp-content/uploads/2021/09/GEBS-2021-04-Achieving-Net-Zero-Ethanol.pdf>.

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ability to produce products with lower carbon intensity to remain competitive in U.S. and world markets. Their competitiveness directly and indirectly benefits Iowa and its citizens via jobs, taxes, and other local benefits from the plants, as discussed in more detail in Section 5 below.

Significantly, facilities in Iowa lack the option to capture and permanently store their CO₂ locally, or to transport their CO₂ long distances to other markets, without the Heartland Greenway Pipeline System. Iowa does not have subsurface geologic formations capable of storing large volumes of CO₂. Thus, without the Heartland Greenway Pipeline System, Iowa and its ethanol plants will be at a significant disadvantage to ethanol plants in states like North Dakota and Illinois, which can utilize proven and established subsurface geologic storage formations in those states. Furthermore, other than the Heartland Greenway Pipeline System, Iowa does not have a long-haul CO₂ pipeline that will offer truck terminal services to enable ethanol and fertilizer plants to effectively compete for and serve industrial users of CO₂ that are not located near CO₂ emitting facilities.

2. **Strengthen the Agricultural Industry.** Second, the Heartland Greenway Pipeline System will strengthen the agriculture industry in general and specifically in Iowa. Strong and durable ethanol and fertilizer plants benefit farmers. The ethanol industry is the largest purchaser of Iowa corn, consuming approximately 57% of Iowa's corn crop each year. A stable ethanol industry provides Iowa's farmers with a reliable market for their corn and underpins the value of 26 million acres of Iowa farmland those crops are grown on. Furthermore, low-carbon fertilizer produced in Iowa can become a high-value input into crop production, and farmers can realistically expect that crops grown using such low-carbon fertilizer will command a premium over those using other higher-carbon inputs.

3. **Environmental Benefits.** Third, the Heartland Greenway Pipeline System will facilitate significant CO₂ emissions reductions that will allow industries in the project footprint to meet their carbon reduction goals to improve overall health and safety of the public and environment. Increased atmospheric carbon dioxide is responsible for about two-thirds of the energy imbalance that is causing Earth's temperature to rise, which has direct and cascading effects on many things including weather, plants and agriculture, disease, water, and ecosystems.⁷ Initiatives around climate change and decarbonization have been discussed for decades at global levels down to local governments and institutions, noting immediate and large-scale progress toward carbon neutrality is needed. Many countries, regions, industries, and institutions have announced decarbonization initiatives. In 2021, the United States announced the Net Zero World Initiative to reach net zero by 2050 and the 2030 Greenhouse Gas Pollution Reduction target to achieve a 50-52% reduction from 2005 levels; to be accomplished by accelerating transitions to net zero, resilient, and inclusive energy systems. The ethanol sector pledged to reduce GHG emissions 70% by 2030 and achieve net zero ethanol by 2050.⁸ Researchers have concluded that of the decarbonation options available to ethanol producers, carbon capture and sequestration is ranked as the most impactful tool to reduce emissions,⁹ such that ethanol can't reach net zero without broad adoption of this

⁷ National Oceanic & Atmospheric Admin., Understanding Climate (last visited April 2022), <https://www.climate.gov/news-features/understanding-climate>.

⁸ Renewable Fuels Ass'n, RFA Pledge to President: Ethanol to Achieve Net Zero Emissions by 2050 or Sooner (July 27, 2021), available at <https://ethanolrfa.org/media-and-news/category/news-releases/article/2021/07/rfa-pledge-to-president-ethanol-to-achieve-net-zero-emissions-by-2050-or-sooner>.

⁹ Isaac Emery, et al., Informed Sustainability Consulting (prepared for Renewable Fuels Ass'n), *Pathways to Net-Zero Ethanol: Scenarios for Ethanol Producers to Achieve Carbon Neutrality by 2050* at p. 24, table 10 (Feb. 14, 2022), available at <https://PathwaystoNetZeroEthanolFeb2022.pdf>.

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technology.¹⁰ Thus projects like the Heartland Greenway Pipeline System contribute to meeting these goals and are measurable in Iowa and the ethanol industry.

Environmental benefits from the capture and permanent storage of CO₂ can be more easily understood utilizing the EPA's Greenhouse Gas Equivalencies Calculator by showing equivalent offsets. **Table 1.0** below shows the project CO₂ emission offsets based on the current project scope in Iowa, the total current project scope, and the amount at full capacity in comparison to IA statistics.

Table 1.0					
Heartland Greenway CO₂ Offset Equivalents					
Scope	Capture	Cars	Homes	Forest Acres	Barrels of Oil
Iowa Volume	4.2 MMT	900K	530K	5 M	9.7 M
Project Volume	7 MMT	1.5 M	882K	8.2 M	16.2 M
Initial Design Capacity	10 MMT	2.1 M	1.3 M	11.8 M	23.1 M
Ultimate Expansion	15 MMT	3.2 M	1.9 M	17.8 M	34.7 M
Source: U.S EPA Greenhouse Gas Equivalencies Calculator					

The estimated 0.4 MMt CO₂e emissions related to pipeline construction (0.1 MMt) and major materials (0.3MMt), is negligible in comparison to the 10 MMT CO₂ the project could initially remove per year, and more so when compared to a projected minimum life of 30 years conservatively assuming the current scope is static. Emissions relative to operating the project are largely power for the capture equipment and booster stations. Using the CO₂ emission information from eGRID, the project's power usage result in emissions of approximately 0.34 MMt CO₂e/year across the footprint and 0.17 MMt CO₂e in Iowa.

Additionally, environmental impacts resulting from construction and operation of the project are expected to be minimal. Construction impacts are inherently temporary in nature and will result in short-term vegetation removal and soil disturbance for installation followed by timely restoration. NHG will obtain the necessary construction permits ensuring minor impacts to waters and natural resources, will implement numerous mitigation measures to minimize impacts and ensure timely and proper restoration; and have a robust inspection program, in addition to regulator inspections, to ensure all conditions and protective measures are implemented. Across the project, disturbed areas will largely revert to pre-construction conditions and land uses, with a notable exception of areas converted to industrial use for the necessary booster stations, launcher receiver sites and valves facilitating safe and proper operation of the system, which is less than approximately 70 acres in Iowa. Details on the construction and mitigation measures are discussed in more detail in the following sections and other exhibits with this submitted with this petition.

4. **Economic Benefits.** The Heartland Greenway Pipeline System will also provide direct benefits to communities located along and near the system footprint. These benefits will include, but are not limited to, providing: temporary construction employment; full-time, local jobs to operate and maintain the pipeline; right-of-way (ROW) payments; additional sales tax revenues from the sale of goods and services during construction and long term operation and maintenance of the pipeline; annual State and local community revenue from property taxes; and long-term support of regional contractors, manufacturers,

¹⁰ Growth Energy, *Achieving Net-Zero Ethanol* (Sept. 2021), available at <https://growthenergy.org/wp-content/uploads/2021/09/GEBS-2021-04-Achieving-Net-Zero-Ethanol.pdf>.

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distributors, and retailers through ongoing purchase of goods and services to operate and maintain the Heartland Greenway Pipeline System.

The overall the Heartland Greenway Pipeline System is a \$3.2-billion-dollar investment directly impacting the local, regional, and national labor force by creating approximately 9,200 construction jobs, of which approximately 5,500 would be in Iowa. As a matter of practice and our promise as part of this project, NHG will utilize American labor to build the pipeline. NHG has executed letters of intent with the various local labor unions in Iowa and nationally to ensure the Heartland Greenway Pipeline System is constructed by highly qualified and experienced labor resources. These well-paying construction jobs will create considerable labor income and state income tax revenue – including the generation of more than \$24 million in ad valorem taxes in Iowa. Upon authorization, the Heartland Greenway Pipeline System will put welders, mechanics, electricians, pipefitters, heavy equipment operators, and others within the heavy construction industry to work.

Construction of the Heartland Greenway Pipeline System will contribute more than \$670 million in direct spending just for pipeline materials and equipment, of which \$422 million will be installed in Iowa. It is expected that a majority of the pipe, valves, fittings, valve actuators, and remaining materials will be manufactured in the United States, creating significant opportunities for regional and national manufacturing. In addition to manufactured goods and services, the Heartland Greenway Pipeline System will provide an estimated \$204 million in easement payments to the landowners whose property is crossed by the proposed pipeline, of which approximately \$133 million are anticipated to go to Iowa landowners.

5. **Safe and Efficient Transportation.** Fourth, the design, construction, and operation of pipelines, including the Heartland Greenway Pipeline System, are heavily regulated and subject to intense scrutiny and oversight. According to the US Department of Transportation, time and time again, pipelines have proven to be the safest, most environmentally friendly, efficient, and reliable mode of transportation for gas and liquids.¹¹

The proposed system connects emitting facilities across Illinois, Iowa, Nebraska, Minnesota, and South Dakota, which lack immediate proximity to the requisite geology for implementing sequestration. Facilities in these areas trying to materially lower their carbon footprint and the carbon intensity of their product must therefore find a means to deliver their CO₂ to available and tested sequestration sites. This necessitates an interstate pipeline system to safely and efficiently transport the material long distances; alternatives to move the System's initial design capacity of 10 MMT/year would require greater than 450,000 trucks or 110,000 railcars per year. And it is clearly understood and communicated by the US Department of Transportation, which regulates all three modes of transportation, that truck and rail transportation are less safe, less efficient, and result in greater environmental impacts than pipelines.

The permanent sequestration location for this project, the Mount Simon Formation, is notably one of the most studied formations for CO₂ sequestration; for decades the US Department of Energy's Carbon Storage Program has researched and implemented technologies that serve as the foundation for CCUS.¹²

¹¹ U.S. Dep't of Transp., Office of Pipeline & Hazardous Materials Safety Admin., Pipeline Safety Regulations (last visited June 2022), <https://primis.phmsa.dot.gov/comm/SafetyStandards.htm>.

¹² Nat'l Energy Tech. Lab., Carbon Transport & Storage Program (last visited May 2022), <https://www.netl.doe.gov/carbon-management/carbon-storage>.

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The Mount Simon Formation is a proven and established location for successful sequestration, is the location of currently active sequestration projects today, has ample availability to sequester billions of metric tons of CO₂, and is readily accessible in central Illinois. Therefore timely, safe, and efficient sequestration for ethanol and fertilizer facilities in Iowa, as well as those in the region, including Nebraska, Minnesota, and South Dakota, require the Heartland Greenway Pipeline System to be installed in parts of Iowa in order to access the Mount Simon Formation sequestration location in Illinois.

Carbon utilization is an existing market where CO₂ is captured prior to emitting to atmosphere and used in a number of ways, including livestock processing and the food and beverage industry. Some of the sources that currently send CO₂ to these markets are the same sources seeking to direct their CO₂ supply to the Heartland Greenway Pipeline System. The proposed off-take facilities maintain a way for CO₂ to continue to reach the food and beverage industries, alleviating scarcity of supply to those markets. Additional products and technologies that would utilize excess CO₂ are being researched and developed; however, a notable limiting factor is cost-effective supply chain to access quality volumes of CO₂. The HGPS off-take facilities thereby will serve as an efficient source of CO₂ for industrial users in their manufacturing processes.

In addition to the foregoing, the Heartland Greenway Pipeline System has the ability to become the backbone infrastructure of new industries or facilities that will locate near the pipeline in order to participate in CO₂ capture and sequestration to lower their products' carbon score and/or to create new low-carbon products utilizing CO₂. The most near-term emerging industry is sustainable aviation fuel (SAF), a substitute for hydrocarbon-based jet fuel. SAF producers are targeting low-carbon ethanol as a primary feedstock to produce SAF and locating near the source of feedstock is economically advantaged. Other low-carbon products in development that can use captured CO₂ or low-carbon ethanol include bioplastics and building products. The Heartland Greenway Pipeline System can support the future of bio-based manufacturing by efficiently increasing availability and access to high quality CO₂ for industrial users.

2.0 THE NATURE OF THE LANDS, WATERS, PUBLIC/PRIVATE FACILITIES CROSSED

2.1 Land Use Overview

The National Land Cover Dataset (NLCD) was used to determine land cover crossed by the proposed Project as provided in **Tables F-1** and **F-1B**.¹³ The NLCD is often used in land use and land cover assessments and initial analyses; the land cover dataset is developed under a partnership among Federal agencies, led by the U.S. Geological Survey (USGS). Each pixel in the dataset is a best estimate of the primary land use or land cover in that area.

The land use impacted by the proposed Project is predominately agriculture (95% of the Project). Predominant agricultural land uses within the Project area are cultivated crops and pasture/hay. These lands are used primarily for production of food, livestock, and fuel crops.

Construction activities will temporarily disturb the land uses within both the construction and permanent ROW. Following construction, these areas will be re-contoured, reseeded, or returned to previous agricultural uses in accordance with Iowa law. Drainage systems such as grassed waterways, roadside

¹³ Multi-Resolution Land Characteristics Consortium, NLCD 2019 Land Cover (last visited October 2022), <https://www.mrlc.gov/data/nlcd-2019-land-cover-conus>.

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ditches and drainage tile crossed and disturbed by the pipeline during construction will be restored in accordance with permit conditions and landowner agreements.

To facilitate the proposed HDD installations, clearing along the profile may be avoided or limited dependent on the resource being drilled. Clearing over the HDD path may be necessary to facilitate access to a water source for mixing with bentonite for drilling mud, for placement of site/wireline placement (an electric guide wire coil, closed loop system, along the ground surface between the HDD entry point and exit point, where possible). NHG will take appropriate measures to protect land uses used for livestock production (pasture/hay) during construction. NHG will coordinate with landowners to isolate livestock from the construction area or will provide temporary fencing and gates where necessary to protect livestock from construction-related hazards. Any fences and gates that were removed or impacted to facilitate construction will have temporary replacements during construction as warranted and will be rebuilt to original condition or better post-construction.

Direct impacts utilities and infrastructure (e.g., existing pipelines and roads) will be avoided through construction design and installation measures. Typically, county roadways will be bored underneath during construction eliminating direct disturbance to the roadway and vegetation. Road crossing methods are discussed further in **Exhibit C**.

Permanent impacts to land use include the conversion of approximately 70 acres to industrial use from current land use for facilities located outside of the customer plants; this includes three, approximately 10-acre booster stations; 12, approximately three-acre launcher/receiver (L/R) sites, and numerous mainline valves (MLVs) which are approximately 30-feet wide by 70-feet long; however the locations and distribution of which are dependent on final routing and design will be determined after completion of necessary surveys and landowner negotiations. More information on these above ground facilities is provided in **Exhibit C**. These above ground facilities are generally located along roads for ease in access by operations personnel and to connect to power and communications. The booster stations will be fenced in with security fence and monitored gates, and will have areas of foundation, driveways, parking, gravel, and grasses; the L/R sites and MLVs will also be fenced and graveled.

After construction, impacts to land uses along the pipeline will be negligible. Operations and maintenance activities may be needed but will be isolated and infrequent. As per the negotiated ROW agreements, no structures can be installed within the permanent ROW, but overall land use will be allowed to revert to pre-construction conditions. Additional information on inconvenience and undue injury are discussed in Section 5 below.

2.2 Regional Landforms and Topography

The state of Iowa is bordered by the Mississippi River on the east and the Big Sioux River and Missouri River on the west. The Project is located within the Central Lowlands of the Interior Plains physiographic region. Specifically, the Project extends through the southern portion of the Western Lake section and the Dissected Till Plains of Iowa.¹⁴

¹⁴ USGS, Physiographic Divisions of the Conterminous U.S. (last visited October 2022), <https://water.usgs.gov/GIS/metadata/usgswrd/XML/physio.xml#stdorder>.

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The route passes through six landform regions, including:

- the Northwest Iowa Plains;
- the Des Moines Lobe;
- the Southern Iowa Drift Plain;
- the Iowan Surface;
- the Loess Hills, and;
- the Alluvial Plains.¹⁵

The Northwest Iowa Plains Region is characterized by gently rolling hills and abundant Loess and is generally barren of timber. Elevation is consistently higher and precipitation is lower than the rest of the state in this region. The combination of glacial tills and abundant Loess in the region has resulted in occasional springs and seeps, primarily found along valley edges and slopes.¹⁶

The Des Moines Lobe Region is characterized by an abundance of moraines and wetlands, prairie potholes and kettle lakes, and several deep lakes. This region is underlain by pebbly clay, sand, and gravel, and many of the region's wetlands have been drained for agricultural use. Loess is absent from this region.¹⁷

The Southern Iowan Drift Plains region is the state's largest landform region, composed primarily of glacial drift, and is characterized by steep hills and valleys containing streams, creeks, and rivers. A layer of loess was deposited over the glacial till in the erosion caused by the streams.¹⁸

The Iowan Surface Region is also characterized by gently rolling hills with long slopes and low relief. Glacial erratics are common throughout the Iowan Surface Region, especially in its shallow valleys.¹⁹

The Loess Hills Region is comprised of uncommonly thick loess (ranging from 60 to 200 feet thick) underlain by glacial sand and gravel deposits. This loess was carved into the steep, peaked hills and narrow ridges that characterize the region now.²⁰

The Alluvial Plains Region is characterized by the alluvium that is deposited on floodplains by the large rivers that flow through Iowa. This region contains backwater sloughs, oxbow lakes, and sand dunes fringing many of these large rivers.²¹

¹⁵ University of Iowa, College of Eng'g, Iowa Geological Survey, Landforms of Iowa (last visited October 2022), <https://iowageologicalsurvey.org/landforms/>.

¹⁶ *Id.*

¹⁷ *Id.*

¹⁸ *Id.*

¹⁹ *Id.*

²⁰ *Id.*

²¹ *Id.*

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2.3 Groundwater

Regional Aquifers

Based on a review of USGA and Iowa Geological Survey (IGS) literature, the Project in Iowa is underlain by four regional aquifers, the Mississippian aquifer, Silurian-Devonian aquifer, the Cambrian-Ordovician aquifer system, and Dakota aquifer.²² The Mississippian aquifer underlies approximately 60 percent of the state of Iowa and the Lower Peninsula in Michigan and consists of thick limestone and dolomite in Iowa. Well screen depths within the Mississippian aquifer range from 100 to 300 feet in north-central Iowa, and 100 to 400 feet in southeast Iowa. Recharge of this aquifer occurs primarily through infiltration of the land surface, and discharge occurs into the Des Moines and Skunk rivers and their tributaries. Water quality in the Mississippian aquifer varies, with total dissolved solids ranging from less than 500 mg/L in north-central Iowa, up to 5,000 mg/L in western and southern Iowa.

The Silurian-Devonian aquifer underlies approximately 90 percent of the state of Iowa, and is present in both Wisconsin and Michigan, as well. This aquifer consists primarily of limestone and dolomite, with interbedded shale and evaporite bed present locally. The general thickness of the Silurian-Devonian aquifer ranges from 200 to 400 feet in eastern and northern Iowa, to 500 to 700 feet in southwestern Iowa. Well screen depths within this aquifer range from 100 to 700 feet. Water quality in the Silurian-Devonian aquifer varies, with total dissolved solids ranging from less than 300 to 500 mg/L in eastern and northern Iowa, up to 5,000 mg/L in central and southern parts of the state.

The Dakota aquifer is primarily located in northwestern Iowa and southwestern Minnesota, but also extends into central and southern Iowa. This aquifer consists of discontinuous sandstone beds ranging in thickness from 200 to 300 feet, overlain and confined in places by limestone and shale beds. Well screen depths within the Dakota aquifer range from 100 to 600 feet and yield 100 to 500 gallons per minute (gpm). Recharge of the Dakota aquifer occurs through downwards movement of water through its confining units, and discharge from the aquifer occurs into major rivers in the region.

The Cambrian-Ordovician aquifer system is located in Minnesota, Wisconsin, Michigan, and throughout Iowa, except for in the northeastern corner of the state. The Cambrian-Ordovician aquifer system is comprised of multiple aquifers separated by leaky confining units. Well screen depths in the Cambrian-Ordovician aquifer system range from 300 to 2,000 feet and yield up to 1,000 gallons per minute. Recharge occurs through leakage from overlying aquifers, primarily in southern Minnesota and northern Iowa.

Major aquifers are described as those aquifers covering a large area and supplying a large amount of groundwater. Minor aquifers are described as those aquifers which cover a small area and supply a large amount of groundwater or cover a larger area supplying a small amount of groundwater. Portions of the Project in Iowa are not underlain by a named basin or principal aquifer, but rather by buried minor aquifers categorized only as “other rocks.” “Other rocks” aquifers include large to small areas that may be designated as major or minor aquifers. They are characterized as areas underlain by low permeability deposits and rocks, unsaturated materials, or aquifers that supply little water because they are localized,

²² Iowa Geological Survey, Aquifer Map (last visited October 2022), <https://www.ihr.uiowa.edu/igs/publications/map/aquifer.html>; USGS, Groundwater Atlas of the United States (last visited October 2022), https://pubs.usgs.gov/ha/ha730/ch_j/.

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have poor permeability, or both.²³ Bedrock aquifers occur within layers of bedrock that are connected hydrologically, and alluvial aquifers occur where sediments have been deposited on stream beds.

Sole Source Aquifers

A sole source aquifer (SSA) is an aquifer designated by the U.S. Environmental Protection Agency (EPA) as the “sole or principal source” of drinking water for a given service area. This designation is given to aquifers that supply 50 percent or more of the drinking water for an area and for which there are no reasonably available alternative sources should the aquifer become contaminated. According to the EPA, the Project is not underlain by any SSAs. The nearest SSA to the Project area is the Mahomet aquifer, which is located approximately 58.5 miles southeast of the Project footprint in Iowa and is located in Illinois.²⁴

Regional Water Districts

The HGPS route passes across areas of regional water districts/associations. Discussions with respective operators have taken and/or will take place, similarly to all other existing utilities and infrastructure, to ensure routing, installation, and operation of the HGPS does not inadvertently impact their operations and vice versa.

Groundwater Impacts and Mitigation

Construction of the Project has the potential to temporarily affect the overland water flow and recharge of shallow aquifers. Clearing vegetation, trench excavation and dewatering, and soil compaction could hinder the infiltration of water into the ground and have an effect on local vegetation and wetland hydrology. However, these impacts will be temporary, and permanent impacts on groundwater are not anticipated.

Conventionally installed pipeline segments via open trench will be buried a minimum of 5 feet below the ground surface. Bores and HDD will typically result in the pipeline being 10 to more than 50 feet below ground, respectively. Alluvial groundwater flow could be impacted if trenching intersects with shallow groundwater. When groundwater is encountered, the trench may need to be dewatered. If trench dewatering is necessary, the water will be pumped out and discharged ideally into a well vegetated upland area. Appropriate BMPs will be utilized to mitigate potential for erosion and off ROW sedimentation.

Where necessary, NHG will install trench breakers (constructed of either sandbags or polyurethane foam) in the trench to ensure that seasonal high water tables do not lead to the diversion of flow down the pipeline trench.

Groundwater quality could be impacted by spills of fuel or other material used during construction. NHG will follow measures described in their Environmental Construction Guidance (ECG), provided as **Exhibit C-3**, to reduce potential impacts from spills during construction and operation of the Project.

2.4 Surface Waters and Wetlands

The proposed route passes through 20 different 8-digit Hydrologic Unit Code (HUC) watersheds: Lower Big Sioux, Rock, Floyd, Little Sioux, North Raccoon, Middle Des Moines, South Skunk, Skunk, Lower Des

²³ *Id.*

²⁴ U.S. Env'tl. Protection Agency, NEPAassist (last visited October 2022), <https://nepassisttool.epa.gov/nepassist/nepamap.aspx>.

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Moines, Flint-Henderson, Upper Des Moines, East Fork Des Moines, Blue Earth, Monona-Harrison Ditch, Blackbird-Soldier, Upper Iowa, Middle Cedar, West Fork Cedar, Shell Rock, and Upper Cedar. Within these watersheds, the proposed route crosses 155 named rivers, streams, and numbered ditches as depicted on maps provide in **Exhibit B**. In addition, tributaries to these named watercourses and adjacent wetlands may also be crossed by the Project. NHG will design and construct these crossings in accordance with applicable regulations. Named watercourses crossed by the Project are depicted in **Exhibit B**. Applicable permits regarding regulated waters are being coordinated with the U.S. Army Corps of Engineers. Iowa has state-owned water bottoms designated Sovereign Meandered Rivers as defined in 571 Iowa Administrative Code Chapter 13. Permits will be sought from the Department of Natural Resources when the HGPS crosses these features which are further discussed below in Public Facilities.

2.5 Public And Private Facilities

The vast majority of the proposed pipeline route passes through private land that is agricultural. There are a few instances where the route crosses a public land, facility, or state-owned water bottom. All public lands and waters are identified below in **Table 2.5** and represent less than 0.2% of route in Iowa. Public facilities proposed to be crossed by HGPS are limited to roads, which are discussed in **Exhibit C** in detailed in **Exhibit C-3**, and the crossing of the Boon Forks Wildlife Management Area; across all of which the HGPS will be installed via trenchless installation (bore or HDD).

Table 2.5 Public and Private Facilities Crossed by the Project								
County	Lateral	Milepost	Facility Name	Facility Type	Responsible Agency	Agency Type	Crossing Length	Proposed Crossing Method
Lee	Trunkline	324.5	Mississippi River	IA Sovereign Waters	IDNR	State	0.6 mile	HDD
Webster	Trunkline	110.4	Des Moines River	IA Sovereign Waters	IDNR	State	0.07 mile	HDD
Emmet	Lakota	35.1					0.03 mile	
Woodbury	Albion	112	Missouri River	IA Sovereign Waters	IDNR	State	0.12 mile	HDD
Bremer	Dyersville	82.9	Cedar River	IA Sovereign Waters	IDNR	State	0.05 mile	HDD
Des Moines	Burlington	9.5	Skunk River	IA Sovereign Waters	IDNR	State	0.06 mile	HDD
Webster	Hartley to Sequestration	110.2	Boone Forks WMA	Wildlife Management Area	IDNR	State	0.2 mile	HDD
Total							1.13 miles	HDD

NHG has designed the HGPS to avoid and minimize impacts to public lands and waters by utilizing trenchless installation methods across these areas (see **Exhibit C** for description of construction method). Additional details regarding measures for crossing these areas will be determined during the respective permitting process with the IDNR.

Though no significant land use conflicts are anticipated on any of the public or private facilities crossed, NHG will work with the corresponding owners, agency, or applicable local planning department to reduce potential impacts to these facilities during construction activities.

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Collocation with existing infrastructure is traditionally a positive route consideration for new infrastructure as it contributes to minimizing the collective impact (e.g., brownfield development, incremental habitat impacts opposed to new habitat fragmentation), and it contributes to local and public awareness of the operating system. NHG maintained traditional collocation siting where feasible, which is where two systems are in abutting easements. However, since routing of the HGPS warrants different siting parameters from existing infrastructure, the separation from another infrastructure system is necessarily larger in certain areas. In Iowa, the route is generally collocated with existing linear infrastructure in areas as depicted in **Exhibit B** maps where the off-set distance from existing infrastructure is approximately 50 to 500 feet; NHG anticipates the final route alignment and collocation with existing infrastructure will change as a result of easement negotiations with landowners.

3.0 POSSIBLE USE OF ALTERNATIVE ROUTES

NHG's key objective in determining the proposed route of the HGPS, including the Iowa section, is minimizing the collective impact from HGPS along its route. NHG did not use a process in which it first expressly identified a set of distinct or largely distinct potential routes for the pipeline segments and then analyzed the competing routes based on a set of criteria to select the optimal route. Instead, NHG utilized a Geographic Information System (GIS) program, Pivvot, to identify multiple paths from the designated starting points to designated ending points, and evaluate them based on multiple publicly available, purchased, and licensed data sets, to identify a preferred baseline route. This GIS program provided suitable baseline pipeline routes between two points utilizing and weighting multiple publicly available, purchased, and licensed data sets that provide information on engineering, environmental, physical, geotechnical, and land use and ownership, and other geographic and demographic features. Features that were considered in the route development process include, but are not limited to: existing linear infrastructure (i.e., railroads, pipelines, and electric power lines, roads); infrastructure and structures (e.g., buildings, wells, levees,); environmental (i.e., wetlands, waterbodies, protected habitats, floodplains); land use (e.g., land cover, conservation easements, land cover, state and national parks, national forests, and wildlife management areas, other federal and state lands, other recreation lands and areas, easements); geological (e.g., slope, topography, depth bedrock, karst, fault lines/areas, landslide potential, peak ground acceleration, mines and mining activity); soils (e.g., series, soils categories, prime farmlands, hydric soils, and corrosivity); cultural (e.g., cemeteries, national register of historic places); and other (e.g., brownfield, superfund, and hazardous waste sites and landfills). Each of the data sets used in the GIS program was weighted, based on whether it represents characteristics desirable for a pipeline route or undesirable characteristics to be avoided. The GIS program also took into account the objective to minimize the overall length of the route, consistent with consideration of the other criteria and constraints (i.e., features to be avoided as described above).

Following generation of these routes, NHG's team of subject matter experts from multiple disciplines performed a micro routing analysis accounting for environmental factors, constructability, and plume modeling, and was further refined utilizing 2021 aerial imagery and lidar information commissioned by NHG and accomplished via flyovers along a wide corridor over the tentative routes. Setback distances from inhabited structures, gathering places, and population centers based on initial plume modeling were established for micro routing efforts, and areas of known cultural resources, including federal and state registered locations, were avoided. The locations of previously recorded sites were obtained from the IA State Historic Preservation Office (SHPO); eligible sites were avoided, potentially eligible sites were avoided or were/will be revisited during cultural resource surveys to gather additional information to

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inform NHG of any additional routing considerations warranted. Additional route refinement is ongoing utilizing information gathered at public informational meetings/open houses, discussions with and information provided by landowners, and on-the-ground civil, environmental, and cultural surveys.

The currently proposed route minimizes the collective impact and maintains the health and safety of the public and environment while meeting the objectives of the Project. Additional route modifications will continue through permitting, and the land acquisition processes to further reduce environmental impacts and account for unique landowner and/or parcel considerations. NHG is committed to working with individual landowners along the route to reach fair and equitable terms and agreements believes this route aids in accomplishing that goal. The proposed route is illustrated in **Exhibit B**.

4.0 THE RELATIONSHIP OF THE PIPELINE TO PRESENT AND FUTURE LAND USE AND ZONING

The proposed Heartland Greenway Pipeline System crosses 33 Iowa counties; these counties have a broad range of land use and zoning restrictions, ranging from developed counties with zoning departments and regulations, to more rural counties with no separate zoning departments or specific land use/zoning restrictions. As of the date of filing, NHG has met, or offered to meet, with representatives of each county that the Project will pass through regarding existing zoning restrictions or planned developments and no conflicts between the Project and existing zoning were identified.

For example, HGPS crosses through the boundaries or extraterritorial jurisdictions of Story City, Fort Dodge, and Hartley located in Story, Webster, and O'Brien counties, respectively. NHG met with representatives from Story City, Story County, Fort Dodge, Hartley, and West Point and will continue to communicate with these and all governments regarding valid land use and zoning development restrictions and planned developments. Route deviations are being or have already been, implemented for planned developments in Story City, Story County, Hartley, and Fort Dodge as a result of these consultations.

Following construction, all temporarily disturbed areas will be returned to preexisting conditions. With the exception of areas for the three booster stations, 12 L/S sites, and numerous MLVs (number and location to be determined with final design) along the HGPS, there will be no operational impacts on land use, except the occasional mowing of the pipeline ROW and there will be no proposed change to the existing or future land use and zoning.

5.0 INCONVENIENCE OR UNDUE INJURY WHICH MAY RESULT TO PROPERTY OWNERS

Most of the inconvenience that may relate to the Heartland Greenway Pipeline System is routine and anticipated by Chapters 9 and 13 of the rules. This includes traffic and construction equipment, typical construction-related noise and activities, as well as temporary disruption to the land, all of which are anticipated and common inconveniences. The Heartland Greenway Pipeline System is being designed and constructed, and will be operated and maintained, to meet or exceed applicable Federal Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations to avoid, mitigate, and minimize the risk of an emergency involving the pipeline that could result in inconvenience or undue injury (see **Exhibit C-3**). The methods for promptly and effectively addressing any such events will be fully addressed in the Facility Response Plan (FRP) required under PHMSA rules and will be completed prior to commencement of

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operations. Further, NHG has included an indemnification clause in all of the easement agreements it is seeking from directly affected landowners which clarifies that liability related to impacts from the pipeline resides with NHG and not the landowner.

PHMSA administers the national regulatory program to ensure safe transportation of hazardous materials by pipelines; it develops safety regulations and risk management approaches to encompass safety in pipeline design, construction, testing, operation, maintenance, and pipeline facilities emergency response. NHG has taken a forward-looking approach to possible regulatory changes with regard to the unique characteristics of transporting CO₂. NHG has conservatively designed the Project, including proactively implementing measures in its operations manual and emergency response plans, so that it will build and operate a state of the art safe and efficient CO₂ management pipeline system. NHG is committed to complying with all applicable existing and future regulations to ensure that the HGPS is a safe and effective midstream solution.

With regard to the more common, construction-related impacts, additional information regarding settlement of damage claims was presented in NHG's Policy Statement Concerning Settlement of Damage Claims sent out to affected parties prior to the public meeting held in each county. A copy of this document is attached as an enclosure to the letters provided as **Attachments G-1 and G-4 to Exhibit G**. The document includes NHG's statements regarding crop loss and damage due to compaction, ruts, and erosion; in addition, the document identifies the manner of damage payments and outlines a dispute resolution procedure.

Following pipeline installation and backfilling, disturbed areas will be restored and graded in accordance with NHG's Agricultural Lands Restoration Plan (**Exhibit I**). Construction debris and organic refuse unsuitable for distribution over the ROW will be disposed of at appropriate facilities in compliance with applicable regulations. Permanent erosion and sediment control measures will be installed as appropriate, and revegetation measures outlined in specific landowner requests, or in the Agricultural Lands Restoration Plan will be implemented. Following the completion of construction, agricultural activities outside of above ground facilities can resume as normal. NHG would require access to the ROW for routine inspections to optimize safe operation and minimize the risk of a release.

Table F-1 Land Uses Crossed by the Heartland Greenway Pipeline System by County (miles)										
County	Barren Land	Cultivated Crops	Pasture/Hay	Forest	Developed	Wetlands	Grassland/Herbaceous	Open Water	Shrub/Scrub	Total ^a
Boone	0	5.19	0.11	0	0.12	0.04	0	0	0	5.46
Bremer	0	26.05	1.43	0.18	0.60	1.17	0.23	0.05	0	29.71
Buchanan	0	22.64	0.68	0.02	0.59	0.09	0.12	0	0	24.14
Buena Vista	0	15.06	1.86	0.03	0.38	0	0.05	0	0	17.38
Butler	0	40.54	1.57	0.36	1.01	0.60	0.15	0.09	0	44.32
Cherokee	0	5.48	0	0.00	0.15	0	0.03	0	0	5.66
Clay	0	29.70	1.83	0.18	0.67	0.50	0.55	0	0.07	33.50
Delaware	0	23.76	0.57	0.01	0.52	0.09	0.04	0	0	24.99
Des Moines	0	7.53	0.47	0.86	0.38	0	0.11	0.06	0.07	9.48
Dickinson	0	13.42	0.37	0	0.51	0.07	0.06	0	0.04	14.47
Emmet	0	32.51	1.77	0.02	0.68	0.16	0.27	0.02	0	35.43
Fayette	0	6.26	0.54	0.11	0.16	0	0.03	0	0	7.10
Floyd	0	13.46	0.06	0	0.32	0.06	0.00	0	0	13.90
Franklin	0	6.48	0.66	0	0.20	0.02	0.12	0	0	7.48
Hamilton	0	15.73	0.13	0	0.39	0	0.08	0	0	16.33
Hardin	0	35.00	0.77	0.47	0.86	0.03	0.00	0.04	0	37.17
Jasper	0	34.07	1.24	0.42	0.96	0.21	0.00	0	0	36.90
Jefferson	0	12.97	2.47	0.52	0.45	0.08	0.18	0	0	16.67
Keokuk	0	6.10	0.04	0	0.16	0	0.00	0	0	6.30
Kossuth	0	15.11	0.05	0	0.25	0.04	0.00	0	0	15.45
Lee	0	41.70	9.60	4.11	1.49	0.26	0.24	0.02	0.21	57.63
Lyon	0.14	41.60	1.24	0.13	1.42	0.27	0.29	0.09	0	45.18
Mahaska	0	29.92	2.97	0.70	0.92	0.10	0.58	0.02	0	35.21
O'Brien	0	61.25	0	0	1.87	0	0.02	0	0	63.14
Osceola	0	3.34	0.09	0	0.15	0	0.00	0	0	3.58
Plymouth	0	23.70	0.79	0	0.49	0.04	0.06	0	0	25.08
Pocahontas	0	28.62	0.23	0	0.65	0	0.02	0	0	29.52
Polk	0	8.05	0	0.03	0.19	0	0.00	0	0	8.27
Story	0	37.67	0.10	0.09	0.81	0.35	0.09	0	0	39.11
Van Buren	0	13.93	1.97	0.65	0.39	0.21	0.00	0	0.05	17.20
Wapello	0	10.64	0.30	0.06	0.28	0	0.07	0	0	11.35
Webster	0	44.87	0.31	0.90	1.04	0.15	0.10	0.05	0	47.42
Woodbury	0	24.49	0.43	0.03	0.60	0.19	0.77	0.07	0	26.58
Total ^a	0.14	736.84	34.65	9.88	19.66	4.73	4.26	0.51	0.44	811.1
^a Numbers have been rounded for presentation purposes; therefore, the total may not equal the sum of the addends.										

Table F-1B Land Uses Crossed by the Heartland Greenway Pipeline System by Lateral (miles)										
Lateral	Barren Land	Cultivated Crops	Pasture/Hay	Forest	Developed	Wetlands	Grassland/Herbaceous	Open Water	Shrub/Scrub	Total ^a
Aurora	0.14	54.47	1.20	0	1.76	0.27	0.17	0.06	0	58.07
Trunkline	0	289.77	18.12	5.65	7.66	1.30	1.52	0.07	0.17	324.26
OCI	0	15.24	3.00	1.13	0.57	0.24	0.02	0.00	0.09	20.29
Burlington	0	10.32	2.16	1.76	0.49	0	0.19	0.08	0.07	15.07
Albert City	0	0.46	0.04	0	0.02	0	0	0	0	0.52
Gowrie	0	8.27	0	0	0.20	0	0.01	0	0	8.48
Jewell	0	8.91	0.04	0	0.21	0	0	0	0	9.16
Charles City	0	93.15	2.86	0.78	2.12	0.74	0.30	0.13	0	100.08
Iowa Falls	0	3.57	0	0	0.11	0	0	0	0	3.68
Shell Rock	0	0.25	0.19	0	0.14	0	0.02	0	0	0.60
Dyersville	0	81.69	3.10	0.37	1.90	1.35	0.42	0.05	0	88.88
Fairbank	0	0.63	0.14	0	0.06	0	0	0	0	0.83
Lakota	0	72.00	2.36	0.02	1.73	0.60	0.60	0.02	0.11	77.44
Welcome	0	9.00	0.09	0	0.16	0	0.03	0	0	9.28
Ashton	0	1.19	0.00	0	0.11	0	0	0	0	1.30
Chancellor	0	8.01	0.13	0.13	0.17	0	0.15	0.03	0	8.62
Albion	0	79.89	1.22	0.03	2.24	0.23	0.86	0.07	0	84.54
Total ^a	0.14	736.82	34.65	9.87	19.65	4.73	4.29	0.51	0.44	811.1
^a Numbers have been rounded for presentation purposes; therefore, the total may not equal the sum of the addends.										